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METHOD OF BLEACHING GROUNDWOOD PULP WEB WITH ACID

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9 Claims

ABSTRACT OF THE DISCLOSURE

A process for bleaching groundwood pulp which comprises: contacting a pulp mass in the form of a damp sheet with an aqueous acidic bleaching solution (0.01 to 1.0 normal) at about room temperature for a period of time from about thirty to ninety seconds, rinsing the so-bleached sheet with an aqueous solution having a pH of from about 7-9 and drying the sheet at a temperature of from about 100° to 300° C.

This invention relates to brightening pulp and more particularly concerns a new and novel method of rapidly brightening groundwood pulps and particularly spruce and poplar groundwood pulps.

Because of the high yields obtained from the grinding operation compared with other pulping processes and the relatively low production costs, groundwood, or mechanical pulp as it is called, is the preferred raw material for the production of lower grade printing paper, such as, for example, newsprint. Moreover, with the introduction in the past few years of modern bleaching processes; a significant broadening of the range of papers in which groundwood could be used was made possible. These bleaching processes, which include the use of, for example, sodium or zinc hydrosulphite, hypochlorites and various peroxides as bleachants, are normally carried out in so-called continuous bleaching towers. In so doing, especially in peroxide bleaching, the pulp is first dewatered or thickened to a density or consistency ranging from, for example, about 1.5 and up to 50 percent or higher in solids, whereupon, the pulp is pumped to the towers. Here it is contacted with a bleachant at an elevated temperature and at a controlled pH for a particular retention time, sufficient to permit completion of bleaching. A normal time for bleaching in this manner to increase the brightness of the pulp, using peroxides, ranges from less than an hour to several hours, e.g., 30 minutes to 3 hours or longer, depending on the pulp and process. The bleached pulp is then discharged from the towers, whereupon, it is neutralized by washing, then dried. Brightness may be increased by bleaching mechanical pulps in this manner, the actual amount depending on the pulp and type and quality of bleachant employed. Points of brightness are normally expressed in the paper industry as "G.E. (spectrophotometer) points of brightness."

Notwithstanding the modern advances in bleaching or brightening groundwood, the present conventional methods still suffer disadvantages in that they either require extended bleaching times, are relatively expensive, or are limited in practice to certain groundwood pulps. Accordingly, there is a need in the art for a simple and economical method of significantly and rapidly brightening mechanical pulps.

An object of the present invention, therefore, is to provide a new and novel method of rapidly bleaching groundwood pulps in sheet form, which is simple and economical.

Another object of the invention is to provide a rapid method of significantly increasing the brightness of mechanical pulps, particularly of spruce and poplar groundwoods in sheet form.

These and other objects and advantages are obtained by subjecting mechanical pulp to the action of a process in accordance with the present invention comprising: providing a groundwood pulp as a slurry thereof having a consistency (termed herein as density), for example, of from about 1.5 to 70 weight percent (based on the dry pulp); forming the pulp preferably into a damp but dewatered sheet of sufficient density and strength to maintain its shape; applying to the sheet so-formed at room temperature, i.e., 25 to 30° C., an acidic aqueous leaching solution, said acidic leaching solution having a normality ranging from about 0.01 to about 1.0 normal, and preferably about 0.05 to 0.1 normal; contacting said leaching solution with said sheet for a period of from about 30 to about 90 seconds, and preferably about 45 to 60 seconds; rinsing the sheet so-leached and brightened with an aqueous solution having, e.g., a pH of from about 7-9, and drying the rinsed sheet preferably at a temperature of from about 100° C. to about 300° C. at least until reasonably dry.

By leaching groundwood pulp in accordance with this novel process using one or more of the acids specified hereinafter and under the conditions stated, unexpected brightness increases in the area of up to about 8-9 points are obtained without the use of conventionally employed bleaching agents. This in many cases is comparable to the increases obtained in conventional bleaching processes. However, with the present process, the brightness increases are obtained in a more rapid, simple and economical manner.

Groundwood pulps for use in the present invention include, for example, those of spruce, poplar, eastern balsam and other common mechanical pulps. The degree of increased brightness obtained with each will, of course, depend on the particular pulp and the various conditions of the present process employed.

Normally, it is preferable that the sheet for leaching have an intermediate (e.g., 10-15%) to high density (e.g., 20% or above). However, low density sheets (e.g., 3-6%) may also be employed. In any event, the sheet, as aforesaid, should have a density such that it readily maintains itself in sheet form since in practice the present process has its greatest utility when accomplished on paper making rollers, screens and the like.

The leaching solution can be conveniently applied to the sheet to be tested by spraying. However, other methods of application may also be employed such as directing a continuous ribbon of the sheet through the acid leachant. Moreover though the solution is preferably applied to the dewatered but damp sheet, the sheet may also be dry.

The acidic aqueous leaching solutions which may be employed in the present process include, for example, water soluble inorganic acids, and also the common water soluble organic acids such as acetic, propionic, and the like. Preferably, sulfuric, hydrochloric or phosphoric acid of the normality hereinbefore specified are employed.

Rinsing of the leached sheet may be done as by passing the sheet through a spray or bath of a rinsing liquid. Preferably, a rinsing liquid will be used which will also neutralize the acid in addition to providing a washing action. For example, an alkaline aqueous solution of sodium hydroxide having a pH of from about 7-9 is suitable when one or more of the mineral acids are used.

Drying of the rinsed sheet is preferably done at a temperature of about 170° C. to 190° C. soon after the

sheet has been rinsed but may also be done at higher or lower temperatures for short or long periods of drying, respectively.

The following examples serve to more fully illustrate the novel method of the present invention and are not to be construed as limiting it thereto.

EXAMPLE I

To illustrate the rapidity and surprising brightening effect obtained using the novel acid leach in accordance with the present invention. 0.8 of a gram of spruce ground-wood pulp was made into a damp sheet about 3½ inches in diameter. About 2.0 cc. of an aqueous sulfuric acid solution having a pH of about 1 and normality of 0.1 was applied thereto for a total contact time of about 45 seconds. The sheet was rinsed with water and dried at 170° C. When evaluated using the standard brightness (G.E.) test, this sheet so-treated showed a brightness of about 65 G.E. points. This is about 7 G.E. points higher than exhibited by the sheet prior to being treated by the acidic leach in accordance with this invention.

EXAMPLE II

To further illustrate the present invention, a number of test sheets of mechanical wood pulp were prepared by slurring about 0.8 gram (oven dried weight) of said pulp for each sample in water, then forming each into a 3½" diameter sheet on a Büchner funnel. The sheets so-prepared were then dried and the brightness of each determined by use of a G.E. Spectrophotometer for control purposes. Next, each sheet was contacted with a known amount of acid leachant for a predetermined time, whereupon, the sheets were either rinsed, or dried without rinsing. The drying was done either at room temperature or at elevated temperatures as indicated. After such drying the sheets were again tested for brightness. The conditions of preparation and the results of the tests are indicated in Table I.

TABLE I.—RESULTS OF LEACHING POPLAR GROUNDWOOD SHEETS

Sample No.	Initial sheet drying		Leachant			Leach time (5) (min.)	Drying		Brightness		Gain in G.E. points of brightness
	Temp. (° C.)	Time (min.)	Acid used	Normality	Vol. used (cc.)		Temp. (° C.)	Time (min.)	Before leach	After drying	
1.....	102	3	H ₂ SO ₄	0.1	2	¼	Air dry		56.15	61.95	5.80
2.....	102	3	H ₂ SO ₄	0.1	2	½	Air dry		56.40	63.00	6.60
3.....	102	3	H ₂ SO ₄	0.1	2	¾	Air dry		55.95	62.80	6.85
4.....	102	3	H ₃ PO ₄	0.01	2	¼	Air dry		58.65	64.70	6.05
5.....	102	3	HCl.....	0.1	2	¼	Air dry		59.3	63.85	4.55
6.....	170	½	H ₂ SO ₄	0.1	2	¼	170	½	53.00	60.75	7.75
7.....	170	¾	H ₂ SO ₄	0.1	2	¼	170	¾	53.95	61.65	7.70
8.....	170	1½	H ₂ SO ₄	0.1	2	¼	170	1½	51.30	59.80	8.50
9.....	170	1½	H ₂ SO ₄	0.1	2	¼	170	1	51.65	60.45	8.80
10.....	200	¾	H ₂ SO ₄	0.1	2	¼	200	¾	53.5	60.9	7.40
11.....	170	1½	H ₂ SO ₄	0.1	2	¼	Air dry		53.75	60.80	7.05
12.....	170	1½	H ₂ SO ₄	0.1	3	¼	Air dry		52.75	59.80	7.05
13.....	170	1½	H ₂ SO ₄	0.1	4	¼	Air dry		53.45	60.55	7.10

NOTE.—Each sheet rinsed five times with 25 cc. portions of water immediately after leaching with acidic salt solution.

Table I clearly illustrates the present novel process and the surprising gains in increased brightness obtained due to leaching the pulp with the acidic leachant in accordance with the present invention. Said brightness increases are especially surprising in view of the short contact or leach times needed to obtain such increases.

The present process may also be applied to other groundwood pulp as well as to poplar or spruce to obtain significant brightness increases.

EXAMPLE III

To illustrate an on-machine application of the present novel process, a sheet of mechanical pulp is formed as usual on a conventional paper machine, blotted or squeezed to reduce the water content to about the 60 to 70 percent consistency range, whereupon the sheet is sprayed with or dipped into a 0.1 N sulfuric acid solution in such a manner that 2 cc. of the solution (or an equivalent amount of acid of higher concentrations) is retained, for example, on for each 0.8 g. of oven dry paper. The paper, wet with the acidic solution, is allowed to proceed on the machine for about 30 seconds, at which time the sheet undergoes a squeezing or blotting step, followed by short

series of water spray rinses, each rinse being followed by a squeezing or blotting operation to further decrease the water content of the paper. The paper thus treated proceeds downstream on the machine for further treatment as normally is applied.

The process of the present invention may be modified or changed without departing from the spirit or scope thereof, and it is understood that the present invention is only limited as defined in the appended claims.

We claim:

1. A method of brightening groundwood pulps consisting of: (1) forming a slurry of said pulp into a sheet thereof, said slurry having a consistency by weight of from about 1.5 to about 70 percent; (2) bleaching said sheet at room temperature with an acidic aqueous leaching solution having a normality of from about 0.01 to about 1.0, wherein said acid is water soluble, for a period of time of from about 30 to about 90 seconds, thereby to brighten said sheet; (3) rinsing the sheet so-leached and brightened with an aqueous rinsing solution; and (4) drying the rinsed sheet.

2. The method of claim 1 wherein the acidic aqueous leaching solution has a normality of from about 0.05 to about 0.1.

3. The method of claim 1 wherein the acidic aqueous solution is a member selected from the group consisting of aqueous sulfuric, hydrochloric or phosphoric acid.

4. The method of claim 1 wherein the contact time of the sheet with the leaching solution is from about 45 to about 60 seconds.

5. The method of claim 1 wherein the sheet after rinsing is dried at a temperature of from about 100° C. to about 300° C.

6. The method of claim 1 wherein the groundwood pulp is a member selected from the group consisting of spruce groundwood or poplar groundwood.

7. The method of claim 1 wherein the slurry is formed

into a dewatered damp sheet prior to contact with the acidic-aqueous leaching solution.

8. The method of claim 1 wherein the consistency of the groundwood slurry is from about 10 to about 70 percent.

9. The method of claim 1 wherein the rinsing solution has a pH of from about 7 to about 9.

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